



System Software

BIOS, Operating Systems and Drivers

You know the old rhyme about bones... the leg bone is connected to the knee bone, the knee bone is connected to the shin bone, the shin bone is connected... and so on. Well that is what we will attempt to do here with system software. We will show you how the most intangible of all computer components, software, is connected and how it works together.

There are two types of software: system software and application software. Application software consists of programs such as word processors, spreadsheets, database managers and desktop publishing programs. System software, which includes BIOS, Operating Systems, Device Drivers and Application Program Interfaces, controls how the applications and hardware interface with the computer. Let us start with the BIOS.

BIOS

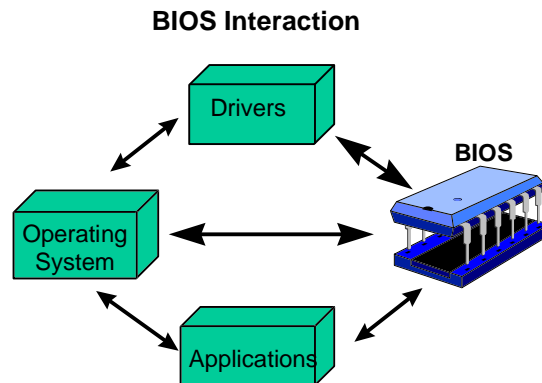
BIOS stands for Basic Input Output System. BIOS was originally written as routines for handling input and output functions but today is generally considered the controlling layer between the computer operating system and the hardware. The BIOS translates commands from software into signals that a particular computer needs to carry out the commands.

Hardware level signals differ from one computer to another. The BIOS ensures that software works the same no matter which brand or model the BIOS is running on. Without the BIOS, programmers would have to write separate operating systems and application software for each hardware configuration they intended to address.

Upon startup the BIOS tests the system and prepares the computer for operation by searching for peripherals and setting pointers in memory. This layer keeps the application software from having to know where and how each component operates. The application program only needs to know how to communicate through the operating system to the BIOS. The BIOS takes care of the tasks requested by the application.



BIOS is located in one or more Read Only Memory (ROM) components, (most commonly in Flash EPROM components) usually found on the motherboard (OK, so it is not exactly *software*, more like firmware). Revisions to the BIOS are constantly being made and can be updated with a simple software upgrade.



Operating Systems

Just as BIOS defines how hardware works, the operating system (OS) defines how application software works with the computer system. Operating systems establish sets of rules for applications to follow such as naming conventions and memory allocation. They also setup various operations such as reading and writing to disk files.

When a computer is turned on, the BIOS searches for specific locations on the disk drive for operating system files. If the computer finds the files, it loads an initial set of instructions into memory. That first set of instructions takes over and loads the rest of the operating system files into memory. This operation is called boot-up because in effect, the operating system is loading itself, or lifting itself by its bootstraps.

Once loaded, the operating system acts as a layer between the application software and the BIOS. When an application issues a command to save a file to a disk, the application does not have to know how or where to save the file. The application makes a standard call to the operating system, which in turn handles that task by communicating with the BIOS to move the file from RAM to disk. The OS communicates the format and location(s) of data, and the BIOS communicates with the hardware to retrieve the data.

Many of today's object oriented operating systems are also responsible for the look and feel of the visual interface (i.e. Windows* 95). An object oriented OS uses objects such as buttons, boxes, lines and icons to represent text based commands. Using a mouse to point and click on an object is the equivalent to typing a command.

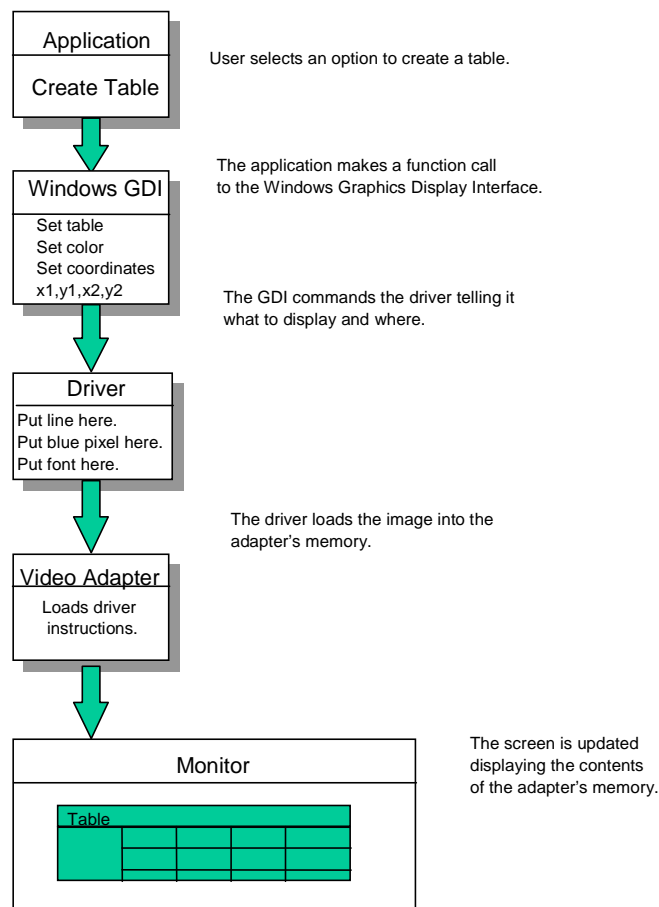
Device Drivers

Operating systems and BIOS cannot possibly be large enough or current enough to include all of the code necessary to control every conceivable hardware device. The code to do this is contained in Device Drivers. Drivers act like extensions of the operating system or BIOS by translating software commands into electrical signals needed to control hard drives, keyboards printers, tape systems, memory and other peripherals.

Each time a hardware device is added to a computer, its driver must be installed in order for it to run. The operating system or BIOS calls the driver and the driver "drives" the device. New features in a hardware device means a new driver is needed to access those new features. If the device is changed, the driver must also be changed or updated.

Software Interaction

The following diagram shows the process for displaying a table in the Windows environment.



The application calls the operating system GDI (Graphics Device Interface) via an API (Application Program Interface). The API is a message format used by applications to communicate with the operating system. APIs are linked to specific program subroutines for execution. The GDI sends commands to the driver that tells the video card specifically where to locate the object. The image is drawn into the video cards memory and is simultaneously sent to the monitor.

Key Points to Remember

- BIOS defines how hardware works with the computer system.
- Without the BIOS, programmers would have to write separate operating systems and application software for each hardware configuration they intended to address.
- The operating system acts as a layer between the application software and the BIOS.
- Every peripheral device requires a driver.
- Drivers provide detailed instructions for controlling the device.